

[FIG. 2]

A1: MANUAL OPERATION COMMAND SW ACTUATED

A2: NEUTRAL WHEN DEPRESSION STOPPED

A3: RELEASED

A4: AUTOMATIC OPERATION PERMISSION SW ON (PERMITTED)

A5: OFF (NOT PERMITTED)

22: CONTROL UNIT (ECU) INCLUDING A DRIVING CIRCUIT
(INCORPORATING A CURRENT SENSOR)

A6: RESPECTIVE SIGNALS

23c: IGNITION SW

23d: WHEEL SPEED SENSOR (FORWARD AND REVERSE ROTATION DETECTION
PROVIDED)

23e: GEAR POSITION SENSOR

23f: BRAKE SW

23g: BRAKE FLUID PRESSURE SENSOR

23h: THROTTLE POSITION SENSOR

23i: GRADIENT SENSOR (G SENSOR)

[FIG. 3]

A1: ACTUATION

A2: RELEASE

[FIG. 4]

22: CONTROL UNIT

A1: SIGNAL 1

A2: SIGNAL 2

A3: SIGNAL 3

A4: SIGNAL 4

[FIG. 5]

A1: DEPRESS TO ON SIDE

A2: NEUTRAL

A3: DEPRESS TO OFF SIDE

A4: ELECTRIC SIGNALS

A5: OPERATION SIGNAL

A6: RELEASE SIGNAL

A7: PORTION CORRESPONDING TO RISE OF SIGNAL

[FIG. 6]

A1: MANUAL OPERATION COMMAND SW OPERATION DETERMINEATION
ROUTINE

S301: READ SWITCH SIGNALS

S302: SIGNAL 1 \neq SIGNAL 2?

S303: SIGNAL 3 \neq SIGNAL 4?

S304: SIGNAL 1=ON?

S305: SIGNAL 3=OFF?

S306: OUTPUT OPERATION SIGNAL

S307: SIGNAL 3=ON?

S308: OUTPUT RELEASE SIGNAL

S309: F/S MODE FOR SW STICKING;

A2: ON_SW FAILURE

A3: OFF_SW FAILURE

A4: ON_SW STICKING or OFF_SW STICKING

[FIG. 7]

S310: IS SIGNAL 1 AT ON-LEVEL?

S311: DETECT SW FAILURE

S312: F/S MODE FOR OPERATION SW FAILURE

S313: DETECT SW POWER SUPPLY FAILURE

S314: F/S MODE FOR OPERATION SW POWER SUPPLY FAILURE

S315: IS SIGNAL 3 AT ON-LEVEL?

S316: DETECT SW FAILURE

S317: F/S MODE FOR RELEASE SW FAILURE

S318: DETECT SW POWER SUPPLY FAILURE

S319: F/S MODE FOR RELEASE SW POWER SUPPLY FAILURE

[FIG. 9]

A1: ELECTRIC PARKING BRAKE SYSTEM MAIN ROUTINE

S2: ENTER SENSOR SIGNALS AND DIAGNOSE FAILURES

S3: FAILURE?

S4: OPERATE F/S

S5: CALCULATE TARGET PULLING FORCE

S6: DETERMINE STOP
S7: IS AUTOMATIC OPERATION PERMISSION SW ON?
S8: AUTOMATIC OPERATION
S9: MANUAL OPERATION

[FIG. 10]

A1: STOP DETERMINATION ROUTINE
S11: ESTIMATED VEHICLE BODY SPEED.2km/h?
S12: RESET STOP DETERMINATION FLAG TO 0
S13: RESET STOP DETERMINATION TIMER
S14: RESET SLOPE JUDGMENT TIMER
S15: IS WHEEL SPEED PULSE OUTPUTTED?
S16: COUNT UP STOP DETERMINATION TIMER
S17: STOP DETERMINATION TIMER \geq [200msec]?
S18: SET STOP DETERMINATION FLAG TO 1
S19: IS BRAKE PEDAL ON?
S20: BRAKE FLUID PRESSURE \geq [1MPa]?
S21: RESET EMERGENCY OPERATION F TO 0
S22: RESET ABS FLAG TO 0
S23: RESET LO- μ FLAG TO 0

[FIG. 11]

A1: AUTOMATIC OPERATION ROUTINE
S31: STOP DETERMINATION FLAG-1?
S32: IS GEAR POSITION SIGNAL P or N?

S33: AUTOMATIC ACTUATION
S34: EMERGENCY OPERATION FLAG=1?
S35: AUTOMATIC RELEASE
S36: IS ACCELERATOR PEDAL OFF?
S37: CONTINUE-OPERATION FLAG=1?
S38: CONTINUE-RELEASE FLAG=1?
S39: IS BRAKE PEDAL ON?
A2: AUTOMATIC RELEASE 1

[FIG. 12]

A1: AUTOMATIC RELEASE 1
S40: IS GEAR POSITION SIGNAL R?
S41: GRADIET<[-5%]?
S42: RESET SLOPE JUDGMENT TIMER
S43: CONTINUE-RELEASE FLAG=1?
S44: IS PREVIOUS GEAR POSITION SIGNAL OTHER THAN R?
S46: GRADIENT>[5%]?
S47: RESET SLOPE JUDGMENT TIMER
S48: CONTINUE-RELEASE FLAG=1?
S49: IS PREVIOUS GEAR POSITION SIGNAL OTHER THAN D?
S50: AUTOMATIC RELEASE
S51: COUNT UP SLOPE JUDGMENT TIMER
S52: SLOPE JUDGMENT TIMER \geq [200msec]?
S53: AUTOMATIC ACTUATION

[FIG. 13]

S54: EMERGENCY OPERATION FLAG=1?

S55: IS GEAR POSITION SIGNAL D?

S56: THROTTLE OPENING>THD?

S57: GRADIENT<[-15%]?

S58: AUTOMATIC RELEASE

S59: AUTOMATIC RELEASE

S60: IS GEAR POSITION SIGNAL R?

S61: THROTTLE OPENING>THR?

S62: GRADIENT>[10%]?

S63: AUTOMATIC RELEASE 2

[FIG. 14]

S64: STOP DETERMINATION FLAG=1?

S66: IS WHEEL SPEED PULSE OUTPUTTED?

S67: IS WHEEL SPEED PULSE ROTATING FORWARD?

S68: ADD ACCUMULATED TRAVELING MILEAGE

S69: SUBTRACT ACCUMULATED TRAVELING MILEAGE

S70: IS GEAR POSITION D?

S71: ACCUMULATED TRAVELING MILEAGE<[-10cm]?

S72: IS GEAR POSITION SIGNAL R?

S73: ACCUMULATED TRAVELING MILEAGE>[10cm]?

S74: ACCUMULATED TRAVELING MILEAGE ABSOLUTE VALUE>[10cm]?

S75: AUTOMATIC PULLING FORCE INCREASE

[FIG. 15]

A1: AUTOMATIC OPERATION ROUTINE

S81: RESET AUTOMATIC RELEASE PROHIBITION FLAG TO 0

S82: RESET CONTINUE-RELEASE FLAG TO 0

S83: AUTOMATIC OPERATION PROHIBITION FLAG=0?

A2: 1= OPERATION PROHIBITED

A3: =0: OPERATION PERMITTED

S84: OPERATION MODE FLAG=0?

A4: =1 OR LARGER: OPERATED

A5: =0: OPERATION NOT PERMITTED

S85: ABNORMALITY DETECTION FLAG=0?

A6: =1: ABNORMAL SENSOR

A7: =0: NORMAL

S86: SET TARGET PULLING FORCE (BfT) TO BfT1

S87: SET TARGET PULLING FORCE (BfT) TO BfT3; AUTOMATIC PULLING
FORCE INCREASE 1

[FIG. 16]

A1: AUTOMATIC PULLING FORCE INCREASE 1

S88: SET TARGET CURRENT (TA) TO $BfT \times \text{CONVERSION COEFFICIENT}$
(a)

S89: ON MOTOR FORWARD ROTATION (DUTY 100%)

S90: IS THERE PREVIOUS OPERATION?

S91: RESET ACTUATION TIMER TO 0

S92: COUNT UP ACTUATION TIMER

S93: ACTUATION TIMER > [100msec] ?
S94: CURRENT VALUE (n) \geq TARGET CURRENT (TA) ?
S95: OPERATION MODE FLAG UP+1 ?
S96: ILLUMINATE OPERATION INDICATOR LAMP
S97: OFF MOTOR FORWARD ROTATION
S98: RESET CONTINUE-OPERATION FLAG TO 0
S99: ACTUATION TIMER \geq [3.0sec] ?
S100: SET CONTINUE-OPERATION FLAG TO 1
S101: EXECUTE F/S PROCESS DURING OPERATION

[FIG. 17]

A1: AUTOMATIC RELEASE ROUTINE
S111: RESET AUTOMATIC OPERATION PROHIBITION FLAG TO 0
S112: RESET CONTINUE-OPERATION FLAG TO 0
S113: AUTOMATIC RELEASE PROHIBITION FLAG=0 ?
A2: =1: RELEASE PROHIBITED
A3: =0: RELEASE PERMITTED
S114: IS THERE PREVIOUS RELEASE OPERATION ?
S115: RESET RELEASE TIMER TO 0
S116: STROKE \leq 0 POSITION + [2mm] ?
S122: RESET OPERATION MODE FLAG TO 0
S117: ON MOTOR REVERSE ROTATION (DUTY 100%)
S118: COUNT UP RELEASE TIMER
S119: RELEASE TIMER \geq [3.0sec] ?
S120: SET CONTINUE-RELEASE FLAG TO 1

S121: EXECUTE F/S DURING RELEASE
S122: RESET OPERATION MODE FLAG TO 0
S123: TURN OFF OPERATION INDICATOR LAMP
S124: OFF MOTOR REVERSE ROTATION
S125: RESET CONTINUE-RELEASE FLAG TO 0

[FIG. 18]

A1: AUTOMATIC RELEASE 2 ROUTINE
S131: RESET AUTOMATIC OPERATION PROHIBITION FLAG TO 0
S132: RESET CONTINUE-OPERATION FLAG TO 0
S133: AUTOMATIC RELEASE PROHIBITION FLAG=0?
A2: =1: RELEASE PROHIBITED
A3: =0: RELEASE PERMITTED
S134: IS THERE PREVIOUS RELEASE 2 OPERATION?
S135: RESET RELEASE TIMER TO 0
S136: STROKE ≤ 0 POSITION + [2mm]?
S141: RESET OPERATION MODE FLAG TO 0
S137: ON MOTOR REVERSE ROTATION (DUTY 50%)
S138: COUNT UP RELEASE TIMER
S139: RELEASE TIMER \geq [2.0sec]?
S140: AUTOMATIC RELEASE

[FIG. 19]

A1: AUTOMATIC PULLING FORCE INCREASE ROUTINE
S151: RESET AUTOMATIC RELEASE PROHIBITION TO 0

S152: RESET CONTINUE-RELEASE FLAG TO 0
S153: AUTOMATIC OPERATION PROHIBITION FLAG=0?
A2: =1: OPERATION PROHIBITED
A3: =0: OPERATION PERMITTED
S154: ABNORMALITY DETECTION FLAG=0?
A4: =1: AMBORNAL SENSOR
A5: =0: NORMAL
S155: SET TARGET PULLING FORCE (BfT) TO BfT1
S156: SET TARGET PULLING FORCE (BfT) TO BfT1; AUTOMATIC PULLING
A6: FORCE INCREASE 2

[FIG. 20]

A1: AUTOMATIC PULLING FORCE INCREASE 2
S157: SET TARGET CURRENT (TA) TO BfT × CONVERSION COEFFICIENT
(a)
S158: ON MOTOR FORWARD ROTATION (DUTY 100%)
S159: IS THERE PREVIOUS AUTOMATIC PULLING FORCE INCREASE
OPERATION?
S160: RESET ACTUATION TIMER TO 0
S161: COUNT UP ACTUATION TIMER
S162: ACTUATON TIMER>[100msec]?
S163: CURRENT VALUE (n) \geq TARGET CURRENT (TA)?
S164: OPERATION MODE FLAG UP+1?
S165: ILLUMINATE OPERATION INDICATOR LAMP
S166: OFF MOTOR FORWARD ROTATION

S167: RESET ACCUMULATED TRAVELING MILEAGE TO 0

S168: ACTUATION TIMER \geq [3.0sec]?

S169: EXECUTE F/S PROCESS DURING OPERATION

[FIG. 21]

A1: MANUAL OPERATION ROUTINE

S171: IS OPERATION SW CHANGED TO LO TO HI?

S172: RESET RELEASE COMMAND FLAG TO 0

S173: COMMAND LEVEL FLAG up+1

S174: RESET ABS, LO- μ FLAG TO 0

S175: IS RELEASE SW ON?

S176: RESET COMMAND LEVEL FLAG TO 0

S177: RESET EMERGENCY OPERATION FLAG TO 0

S178: SET RELEASE COMMAND FLAG TO 1

[FIG. 22]

S179: RELEASE COMMAND FLAG=1?

S180: CALCULATE EACH PARAMETER

S181: COMMAND LEVEL FLAG \geq 1?

S183: RESET TARGET DECELERATION 0.0G

S184: MANUAL OPERATION

S185: RESET TARGET DECELERATION TO 0.0G

S186: MANUAL RELEASE

S187: LO- μ FLAG=0?

S188: IS OPERATION SWITCH LEVEL HIGH?

S189: $GRF \leq$ TARGET DECELERATION?
S190: UPDATE TARGET DECELERATION TO GRF
S191: CALCULATE TARGET DECELERATION BY COMMAND LEVEL $\times -0.15G$
S192: SET EMERGENCY OPERATION FLAG TO 1

[FIG. 23]

S194: SET LO- μ FLAG TO 1
S196: CALCULATE TARGET DECELERATION BY $GRF \times 90\%G$
S197: SET ABS FLAG TO 1
S198: RESET CONTINUATION TIMER TO 0
S199: $STROKE \leq 0$ POSITION + [2mm]?
S200: ON MOTOR REVERSE ROTATION
S201: VEHICLE BODY SPEED $< [-0.4G]$?
S202: VEHICLE BODY SPEED $<$ TARGET DECELERATION?
S203: RESET CONTINUATION TIMER TO 0
S205: COUNT UP CONTINUATION TIMER
S206: CONTINUATION TIMER $> [500msec]$?
S207: RESET ABS FLAG TO 0
S208: ABS FLAG = 1?
S209: SET MOTOR DUTY TO LESS THAN 100%
S210: SET MOTOR DUTY TO 100%
S211: ON MOTOR FORWARD ROTATION

[FIG. 24]

A1: MANUAL OPERATION ROUTINE

S221: IS AUTOMATIC RELEASE DETERMINED?

S222: SET AUTOMATIC RELEASE PROHIBITION FLAG TO 1

S223: RESET AUTOMATIC OPERATION PROHIBITION FLAG AND
CONTINUE-OPERATION/RELEASE FLAG TO 0

S224: STOP DETERMINATION =1?

S225: ABNORMALITY DETECTION FLAG=0?

A2: =1: ABNORMAL SENSOR

A3: =0: NORMAL

S226: SET TARGET PULLING FORCE (BfT) TO BfT1

S227: SET TARGET PULLING FORCE (BfT) TO BfT2

S228: SET TARGET PULLING FORCE (BfT) TO BfT3

A4: AUTOMATIC PULLING FORCE INCREASE 3

[FIG. 25]

A1: AUTOMATIC PULLING FORCE INCREASE 3

S229: SET TARGET CURRENT (TA) TO BfT × CONVERSION COEFFICIENT
(a)

S230: ON MOTOR FORWARD ROTATION (DUTY 100%)

S231: IS THERE PREVIOUS OPERATION?; S232: RESET ACTUATION TIMER
TO 0

S233: COUNT UP ACTUATION TIMER

S234: ACTUATION TIMER > [100msec]?

S235: CURRENT VALUE (n) \geq TARGET CURRENT (TA)?

S236: OPERATION MODE FLAG UP+1?
S237: ILLUMINATE OPERATION INDICATOR LAMP
S238: OFF MOTOR FORWARD ROTATION
S239: RESET COMMAND LEVEL FLAG TO 0
S240: ACTUATION TIMER \geq [3.0sec]?
S241: EXECUTE F/S PROCESS DURING OPERATION

[FIG. 26]

A1: MANUAL RELEASE ROUTINE

S251: IS AUTOMATIC OPERATION DETERMINED?
S252: SET AUTOMATIC OPERATION PROHIBITION FLAG TO 1
S253: RESET AUTOAMTIC OPERATION PROHIBITION FLAG AND
CONTINUE-OPERATION/RELEASE FLAG TO 0
S254: IS THERE PREVIOUS RELEASE OPERATION?
S255: RESET RELEASE TIMER
S256: STROKE \leq 0 POSITION + [2mm]?
S261: RESET OPERATION MODE FLAG TO 0
S262: TURN OFF OPERATION INDICATOR LAMP
S263: OFF MOTOR REVERSE ROTATION
S264: RESET RELEASE COMMAND FLAG TO 0
S257: ON MOTOR REVERSE ROTATION (DUTY 100%)
S258: COUNT UP RELEASE TIMER
S259: RELEASE TIMER \geq [3.0sec]?
S260: EXECUTE F/S PROCESS DURING RELEASE

[FIG. 27]

A1: PULLING FORCE

A2: UPPER LIMIT

A3: PULLING FORCE REQUIRED WHEN LOADED AS REGULATED

A4: PULLING FORCE REQUIRED WHEN LOADED LIGHTLY

A5: GRADIENT

[FIG. 28]

A1: GRADIENT

A2: THROTTLE OPENING THRESHOLD THD

[FIG. 29]

A1: OPERATING SW

A2: RELEASE SW

A3: WHEEL SPEED V_w

A4: CURRENT

A5: STROKE

A6: VEHICLE BODY DECELERATION GRF

A7: 0 POSITION

A8: TARGET DECELERATION G_t

A9: TIME

[FIG. 30]

A1: OPERATION SW

A2: WHEEL SPEED V_w

A3: CURRENT
A4: STROKE
A5: VEHICLE BODY DECELERATION GRF
A6: TARGET DECELERATION G_t
A7: 0 POSITION
A8: TIME

[FIG. 31]

A1: OPERATION SW
A2: WHEEL SPEED V_w
A3: SLIP AMOUNT REGULATING VALUE
A4: REAR WHEEL ACCELERATION AND DECELERATION R_rG
A5: CURRENT
A6: VEHICLE BODY DECELERATION GRF
A7: FRONT WHEEL ESTIMATED VEHICLE BODY SPEED V_{rF}
A8: TARGET DECELERATION G_t
A9: TIME